

REMARKS

OBJECTION TO THE DRAWINGS

The Draftsperson has objected to the drawings under 37 CFR 1.84 or 1.152 for the reasons stated in the Notice of Draftsperson's Patent Drawing Review. These objections have been addressed and a copy of formal drawings is attached hereto. Accordingly, it is submitted that the draftsperson's objections have been overcome.

OBJECTION TO THE SPECIFICATION

A further copy of the specification, as originally filed, with lines double spaced on good quality paper is attached hereto. Accordingly, it is submitted that this objection has also been overcome.

REJECTION OF THE CLAIMS

The Examiner is thanked for the Interview granted to the Applicant on Thursday 29, 2003 and the useful feedback received therein. Based on the interview and the argument set out below, reconsideration of this application is earnestly requested.

Claims 1 - 33 stand rejected under 35 U.S.C. 103 (a) as being unpatentable over U.S. Patent 6,337,999 (hereinafter referred to as "Orban") in view of Applicant's admitted known prior art. This rejection is respectfully traversed. The amendments introduced are by way of clarification and no new limitations have been introduced into the claims and, accordingly, no further search is required.

To establish a **prima facie** case of **obviousness**, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art and not based on applicant's disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

In view of the above requirements, it is submitted that it would **not** be obvious to include an interpolator having associated therewith a second transition band in the form of an interpolation filter in the system of Orban as submitted in the Office Action.

Claim 1, as amended, reads as follows:

“A method for converting an input signal to one of a plurality of differing output sample rates, the method comprising:

receiving at an input sample rate, a plurality of data points, associated with the input signal;

operating on said plurality of data points to associate said input signal with a predetermined set of parameters, with said set of parameters including a first transition band having an image corresponding thereto;

dynamically varying said input sample rate associated with said input signal to any one of the plurality of differing output sample rates by interpolation **with an interpolator having associated therewith a second transition band**, with the width associated with said second transition band being a function of the spectral separation of said first transition band and said

image, and wherein a second signal is produced having a sequence of data samples approximating the input signal.

Insofar as the rejection of claim 1 is concerned, the Office Action acknowledges that Orban "does not specify:

- **the interpolator that varies the sample rate has a second transition band associated with it**
- **the width of this second transition band is a function of the spectral separation of the transition band and image of the input signal"**

However, in this regard it is important to appreciate that Orban does not disclose an "interpolator" as claimed in claim 1. The interpolator of claim 1 includes the feature of "dynamically varying said input sample rate associated with said input signal to any one of the plurality of differing output sample rates," and must also have **"associated therewith a second transition band."** Orban uses the word "interpolator" only once (see col. 5, line 26) and only in the context of an upsampler, and thus in the context of inserting zeros into the signal. Clearly Orban does not describe obtaining **differing output sample rates** based on an interpolation process. Also, clearly Orban's "interpolator," being an upsampler which is merely inserting zeros into the signal, does not have any associated transition band. The operation of inserting zeros has no effect on the spectrum of the signal.

It is thus submitted that neither Orban nor the prior art description of the present application teach or even suggest **an interpolator having associated therewith a second transition band.**

Nevertheless, the Office Action argues that "[t]o one of ordinary skill in the art at the time of the invention, it would have been obvious to include an **interpolation filter** in the system of Orban as disclosed as prior well known art in the specification of the application."

Orban discloses a cascaded arrangement of up and down sampler/half-band filter arrangements to reduce the problem of aliasing and other problems associated with performing clipping in the digital domain. To do so, Orban merely converts the signal to a higher sampling rate, performs a clipping operation at the higher sample rate, and then returns the signal to the original sample rate. The functional steps in Orban are thus increase the sampling rate, operate, and reduce the sampling rate and this is done using one or more up or down sampler/half-band filter arrangements each of which has a **fixed ratio**. Orban's interpolators, whether considered alone or in combination with their associated filters, never allow "dynamically varying" the sampling rate.

As conceded by the Office Action, Orban does not disclose the feature wherein "**the interpolator that varies the sample rate** has a second transition band associated with it" where "the width of this second transition band is a function of the spectral separation of the transition band and image of the input signal." However, the subsequent assertion in the Office Action that "the motivation behind substituting a combined **interpolation filter** for the separate interpolator and filter would have been that it would have made each handling of the input values more efficient" is incorrect.

Firstly, claim 1 of the present invention claims an "interpolator" that has the feature of dynamically varying said input sample rate associated with said input signal to any one of the plurality of differing output sample rates by interpolation. The disclosure in Orban would be incapable of dynamically varying the sample rate to **different sample rates**.

Secondly, if the "interpolator" of claim 1 is construed as an "interpolation filter" it should be noted that Orban comments that "[t]he embodiment of Fig. 2 is particularly economical and efficient by its use of cascaded 2x interpolators and decimators interleaved with polyphase half-band FIR filters." (See Orban col. 5, lines 26 - 29). Clearly, Orban advocates cascading separate stages for the

purpose of efficiency and thus teaches away from combining them in any manner. In this regard it is important to bear in mind that, as stated above, the teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art and not based on applicant's disclosure. Orban in no way teaches or suggests the combination of two transition bands but in fact teaches away from it.

In addition, it is important to note that Orban has cascaded upsamplers and downsamplers that provide fixed sample rate conversion. The present invention, as claimed, provides for “converting an input signal to one of a plurality of **differing output sample rates**.” In Orban the input signal is converted to differing sampling rates wherein each conversion to a different sampling rate requires an additional filter stage. In the present invention, the sample rate can be varied with a single interpolator, and converting the input signal to differing sample rates may be accomplished by a single interpolator. It will be appreciated by one skilled in the art that substituting a less efficient variable interpolation filter for the task of fixed sample rate conversion would be pointless and result in decreased efficiency.

Thus, it is submitted that neither Orban nor the prior art filter descriptions in the present application teach or suggest the present invention, whether taken alone or in combination. Although the Office Action has provided a motivation to combine the teaching, it is submitted that the motivation provided in the Office Action is incorrect. Further, the motivation is not provided in the prior art reference (i.e. Orban), which actually teaches away from the present invention.

From at least the foregoing reasons, it is respectfully submitted that claim 1, as amended, is not obvious in the light of Orban in view of the Applicant's admitted known prior art and that claim 1 is indeed allowable.

Claim 17 includes the features of claim 1 described above and, for the same reasons, it is submitted that it is also allowable.

Claims 2 - 11, and 18 - 22 are dependent upon independent claims 1, and 17 respectively. Accordingly, claims 2 - 11, and 18 - 22 are also allowable.

Claim 12, as amended, reads as follows:

"A method for converting a digital audio signal to a different sample rate, the method comprising:

receiving a plurality of data points, associated with an audio signal, at an initial sample rate;

half-band filtering said plurality of data points with a half-band filter to provide intermediate data points; and

interpolating the intermediate data points with **an interpolator having independently programmable parameters**, and wherein the different sample rate is provided by interpolating at least a subset of the intermediate data points based on the independently programmable parameters.

Claim 12 has been amended to clarify the feature of the "**interpolator having independently programmable parameters**." In particular, the relationship between the different sample rate, as mentioned in the preamble to the claim, and interpolation based on the independently programmable parameters has been clarified.

Unlike, the interpolators in Orban, the interpolator according to the present invention may have its parameters changed during operation thus allowing conversion of the sample rate to different sample rates. For example, as described, *inter alia*, on page 18, lines 28-31, "[a]t step 1014, the sample rate associated with the signal x_n and, therefore, the intermediate signal w_k is varied by interpolating a subset of data points of the plurality of data points with the interpolator 604." Thus, the specification, describing an exemplary embodiment, provides that "ROM 506 stores information that is operated on by host processor 502 or digital signal processor to function as a sample rate converter capable of conversion by a rational, irrational or time varying ratio R . The ratio R is

approximated by a rational value L/M , where L and M are integers that can slowly change with time.” (See page 12, lines 25 - 28 of the present specification).

Orban does not teach or even suggest **independently programmable parameters** to provide a varying sample rate. In order to vary the sample rate in Orban, a plurality of cascaded **fixed ratio** upsamplers and downsamplers are provided wherein each upsampler or downsampler has a ratio of two. For example, Orban states that “[t]his process is repeated three or more times (by upsampler/filter pairs 201/401, 202/402, and 203/403) to create a signal upsampled to 768 kHz sample frequency...” (See column 4, lines 4 - 6).

The description of the prior art filters in the present application does not describe any filters with **independently programmable parameters** for converting a digital audio signal to a different sample rate. Thus, neither Orban nor the prior art description in the specification disclose or even suggest the feature of claim 12 of “interpolating the intermediate data points with an interpolator having independently programmable parameters, and wherein the different sample rate is provided by interpolating at least a subset of the intermediate data points based on the independently programmable parameters” as clarified in the proposed amendment. In fact as mentioned above, Orban teaches away from the present invention that varies programmable parameters, as opposed to the prior art that merely increasing the number of upsamplers or downsamplers, to change the sample rate.

From at least the foregoing reasons, it is respectfully submitted that claim 12, as amended, is not obvious in the light of Orban in view of the Applicant’s admitted known prior art and that claim 12 is indeed allowable.

Claim 23, as amended, includes the features of claim 12 described above and, for the same reasons, it is submitted that it is also allowable.

Claims 13-16, and 24-27 are dependent upon independent claims 12, and 23 respectively. Accordingly, claims 13-16, and 24-27 are also allowable.

Claims 28, 30, and 32 are dependent upon independent claims 1 or 12 that are submitted to be allowable. Accordingly, claims 28, 30, and 32 are also allowable.

Claims 29, 31, and 33 are dependent upon independent claims 17 or 33 that are submitted to be allowable. Accordingly, claims 29, 31, and 33 are also allowable.


From at least the foregoing reasons, it is respectfully submitted that claims 1 - 33 are allowable and allowance of the application is earnestly requested.

If there are any additional fees associated with this communication, please charge our Deposit Account No. 02-2666.

Respectfully submitted

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